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Renjilian

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(54) **DISPENSING BIN FOR MULTIPLE MATERIALS**

(75) Inventor: **Jason Renjilian**, Newtown, CT (US)

(73) Assignee: **Sealed Air Corporation**, Elmwood Park, NJ (US)

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USPC **221/92**; 221/174

(58) **Field of Classification Search**
USPC 221/1, 92, 174
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,428,246	B1	8/2002	Landrum	
6,519,916	B1	2/2003	Brown	
6,910,610	B2	6/2005	Barlett et al.	
6,996,955	B2	2/2006	White, Jr. et al.	
7,273,142	B2	9/2007	Huis et al.	
7,318,459	B2	1/2008	Frankeberger et al.	
7,534,074	B2	5/2009	Kato	
7,823,367	B2	11/2010	Boigues et al.	
7,914,239	B2	3/2011	Van Huis	
8,261,939	B2 *	9/2012	Knoth	221/103
2003/0079439	A1	5/2003	Brown	
2006/0042190	A1	3/2006	Garceau et al.	
2007/0020162	A1 *	1/2007	Scudder et al.	422/307
2008/0128423	A1 *	6/2008	Rick et al.	220/500
2008/0148955	A1 *	6/2008	Neace et al.	99/279
2008/0164253	A1 *	7/2008	Truong	220/4.27
2008/0283551	A1 *	11/2008	Hoff et al.	222/1
2012/0209420	A1 *	8/2012	Christy et al.	700/218
2013/0161211	A1 *	6/2013	Oren	206/221
2013/0161354	A1 *	6/2013	Oren	222/185.1
2013/0226337	A1 *	8/2013	Leech et al.	700/235
2013/0233878	A1 *	9/2013	Lindmayer	222/1
2013/0233895	A1 *	9/2013	Landman et al.	222/399

OTHER PUBLICATIONS

Brochure for Jet Stream™ Delivery Solutions, 2008, published by Sealed Air Corporation.

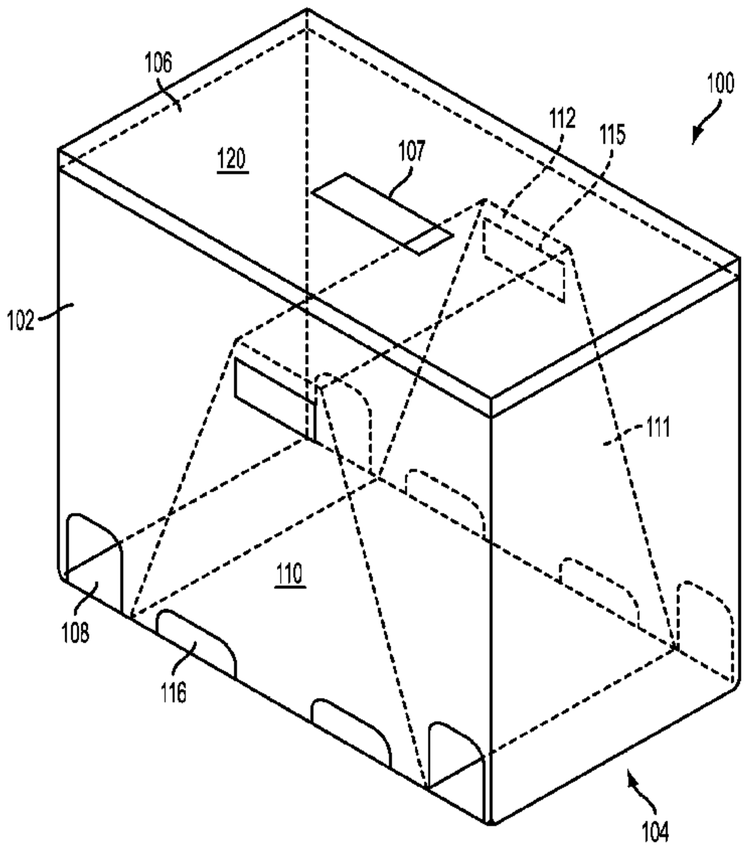
* cited by examiner

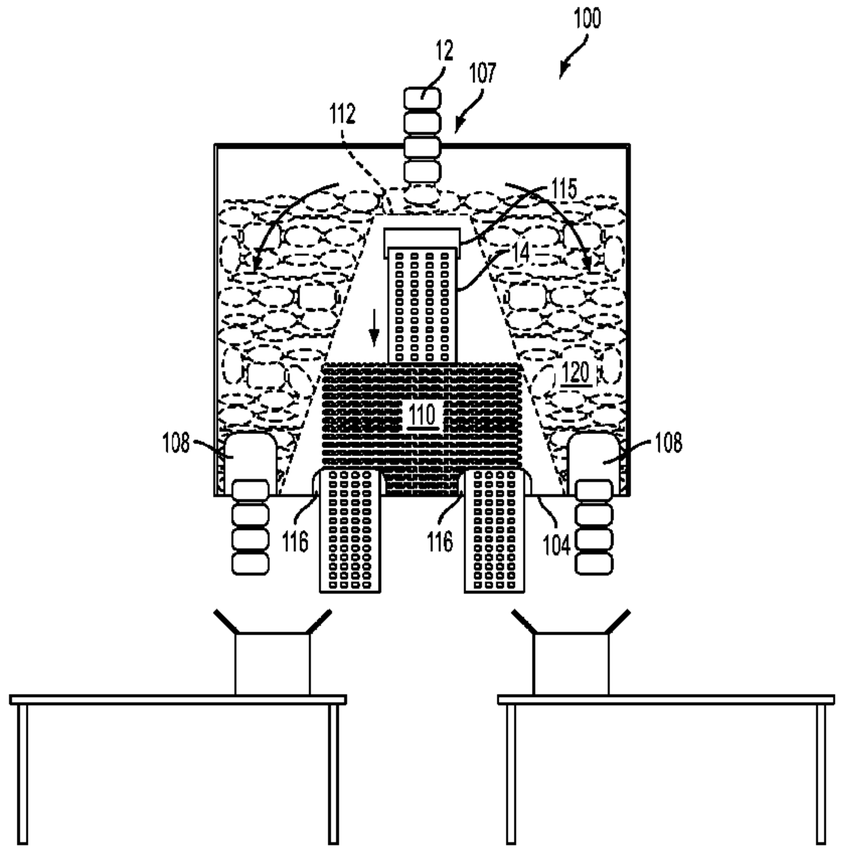
Primary Examiner — Alexandra Elve
Assistant Examiner — Eyamindae Jallow
(74) *Attorney, Agent, or Firm* — Alston & Bird LLP

(57) **ABSTRACT**

Various embodiments of the present invention are directed to systems for dispensing multiple types of materials, such as packing materials. According to various embodiments, the systems include a dispensing bin with multiple compartments configured to receive and dispense different types of materials, such as air-filled dunnage cushions and air-filled protective material. In certain embodiments, the dispensing bin is configured to receive materials from one or more supply machines and dispense the materials such that more than one type of material is provided to numerous packing stations for use in packaging items.

17 Claims, 7 Drawing Sheets





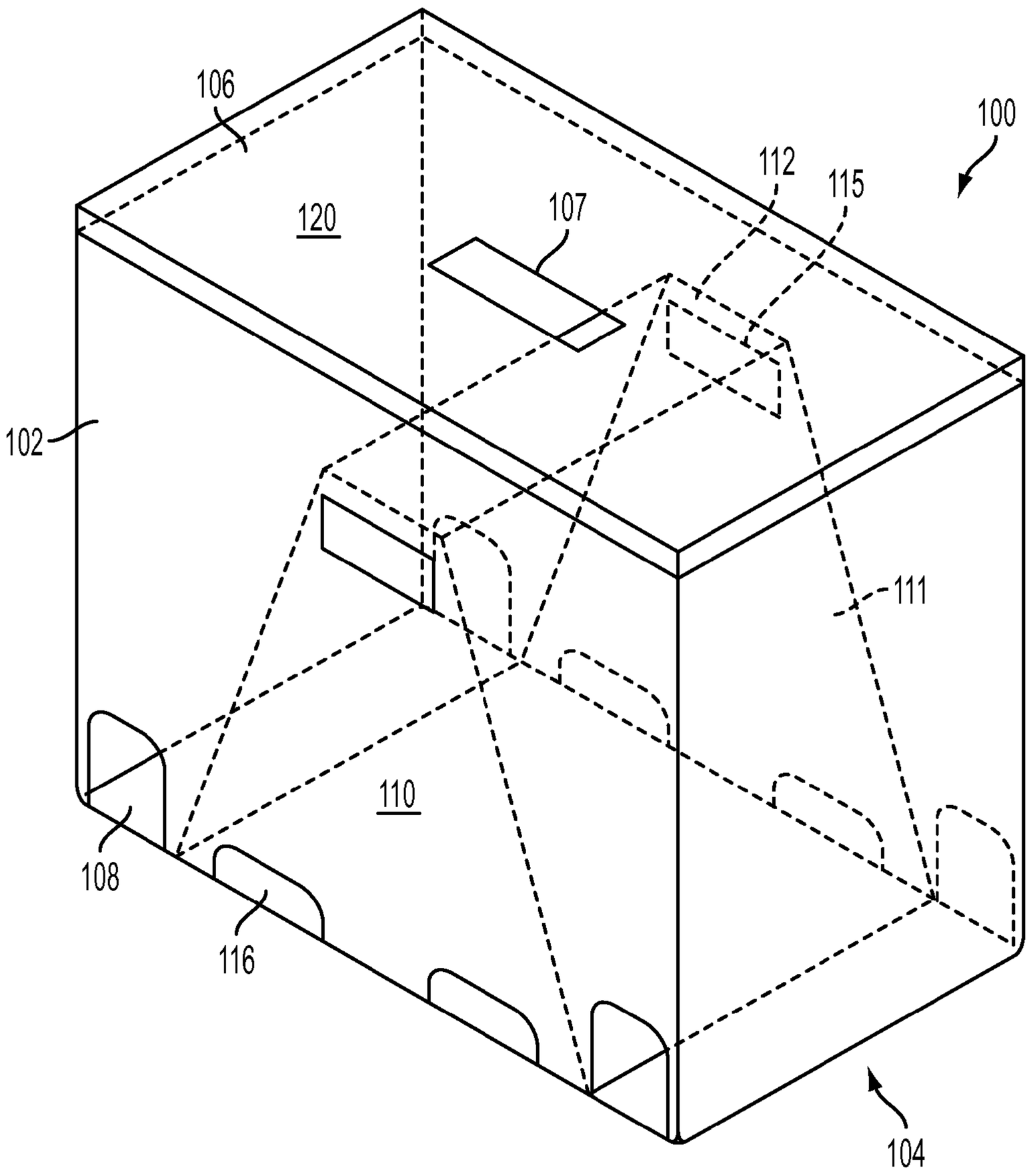


FIG. 1

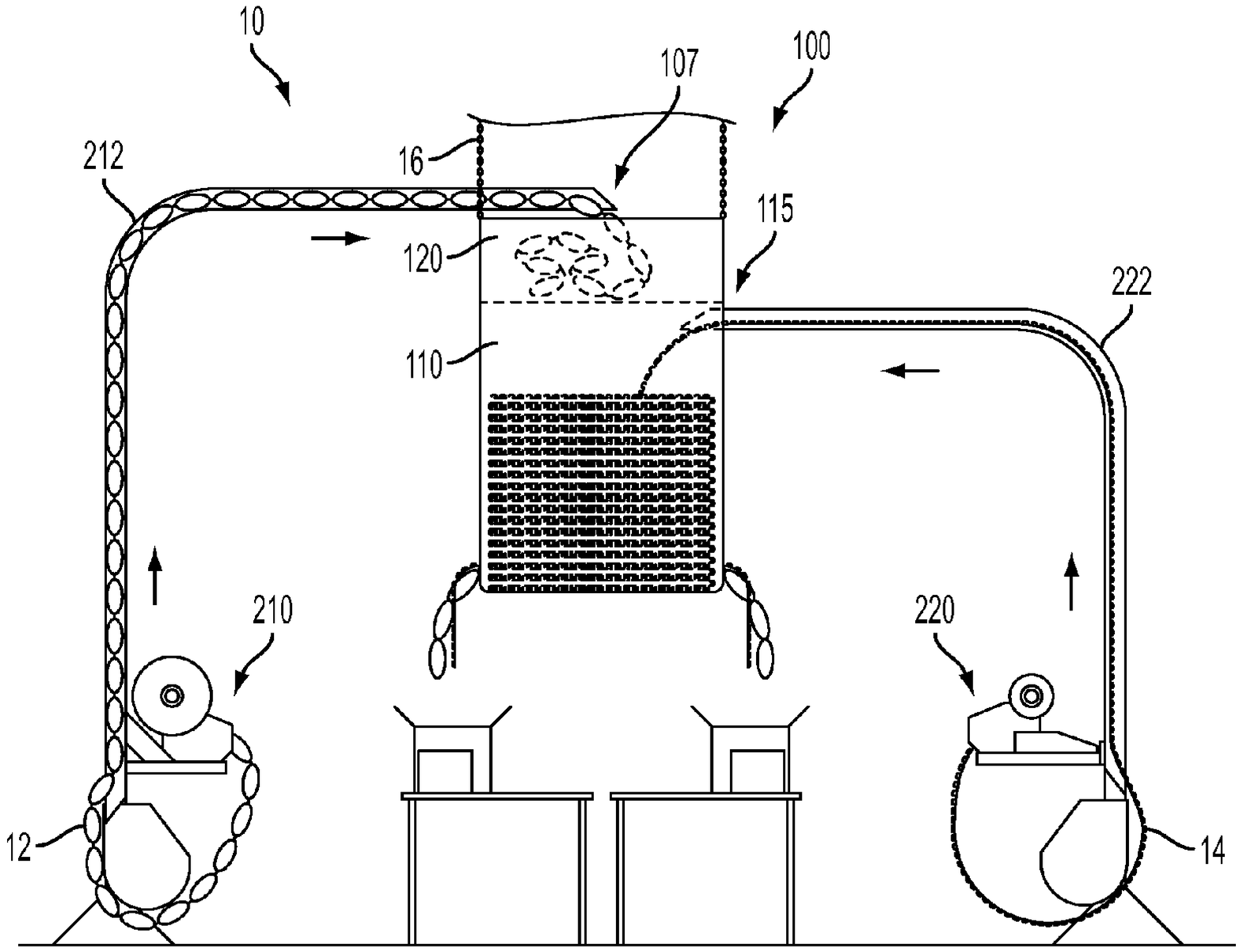


FIG. 2

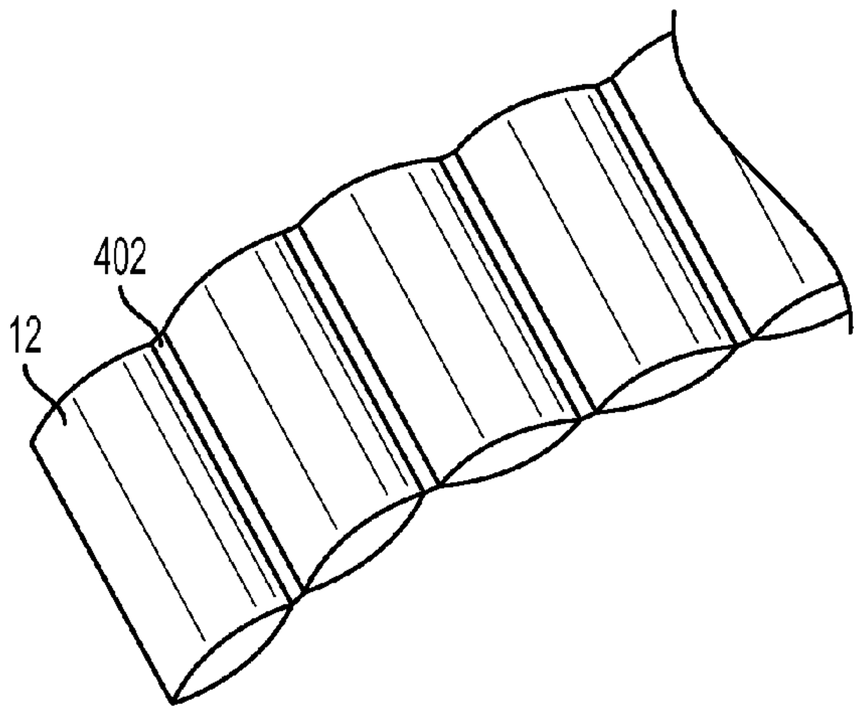


FIG. 3

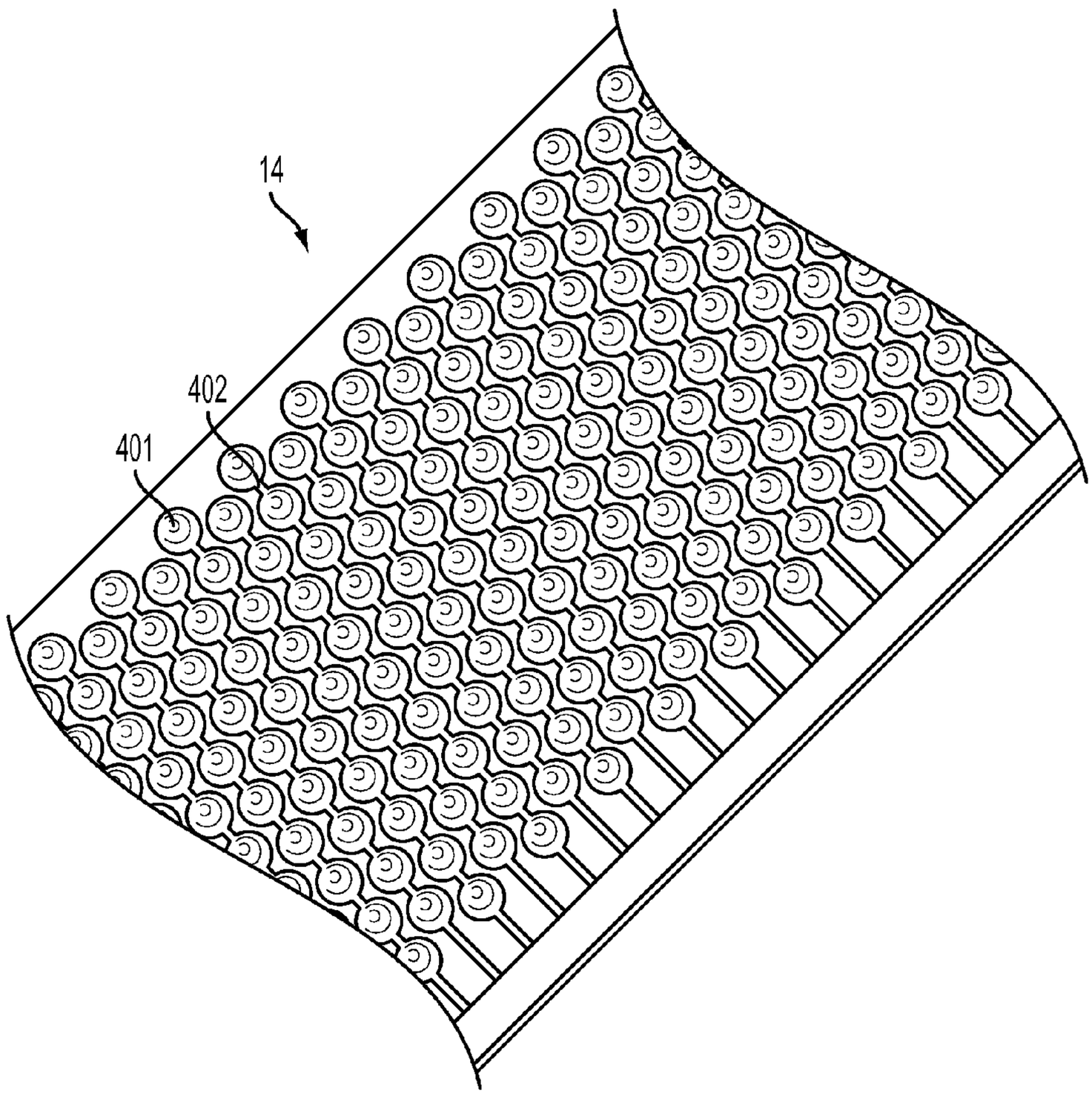


FIG. 4

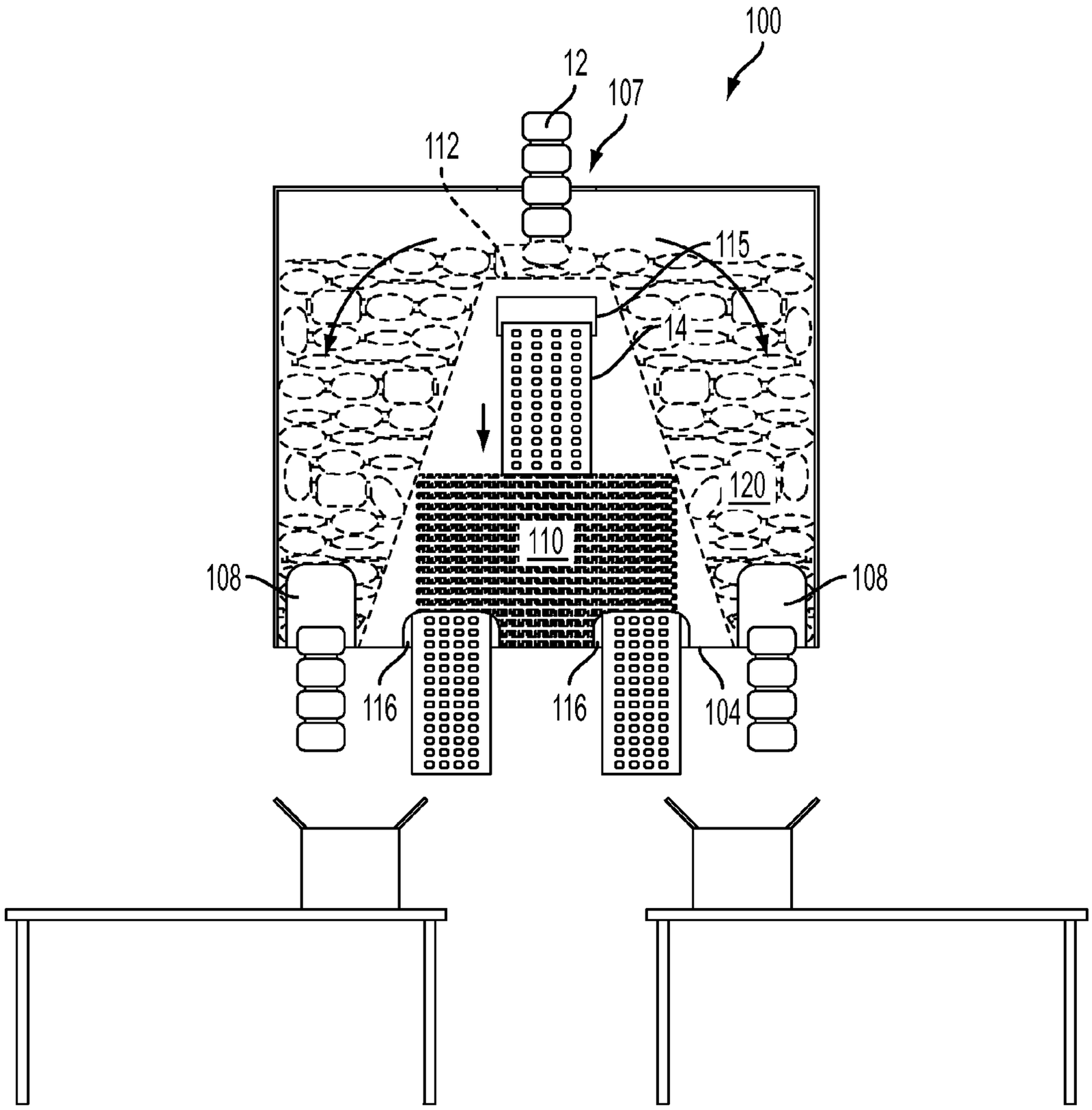


FIG. 5

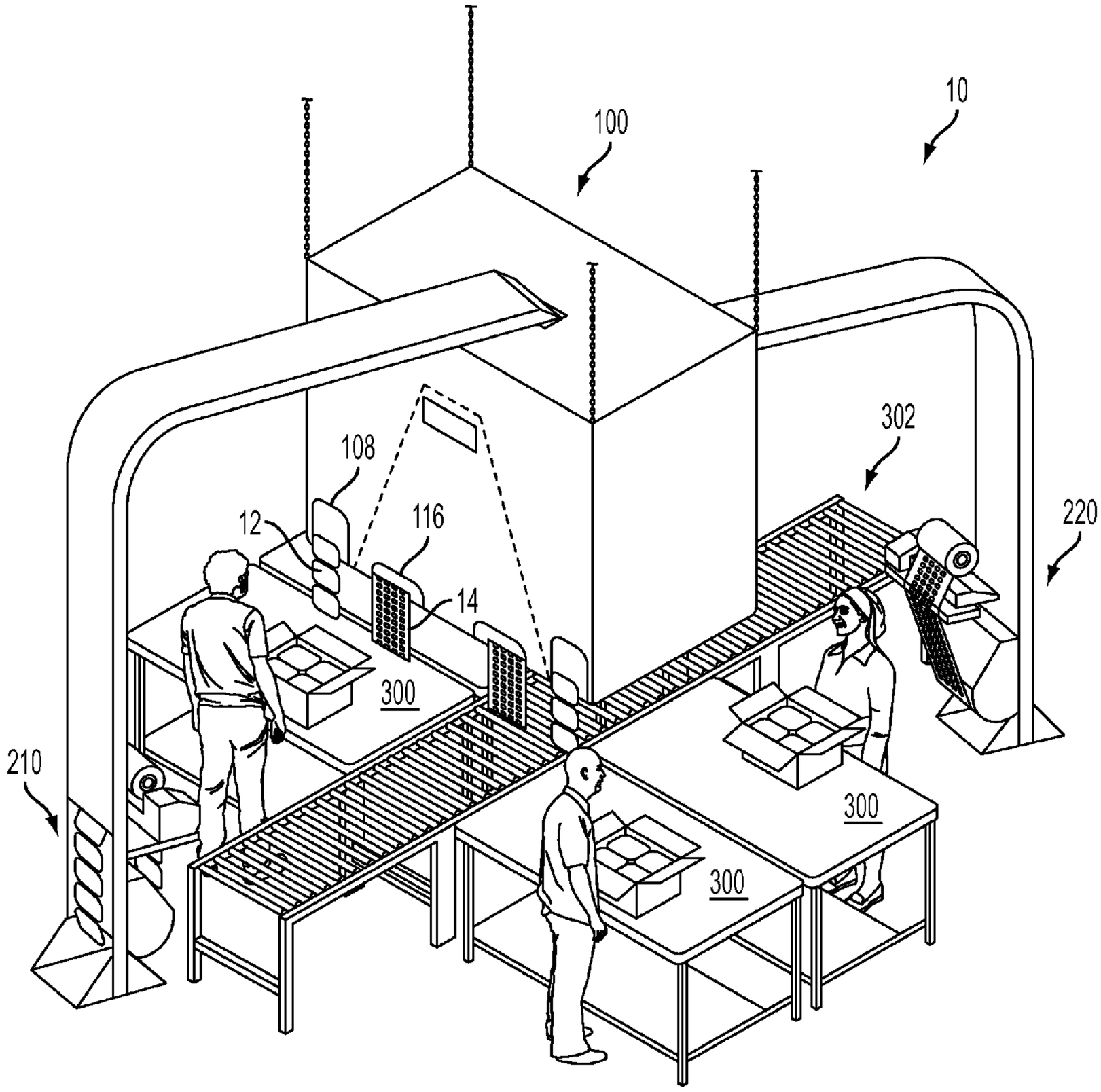


FIG. 6

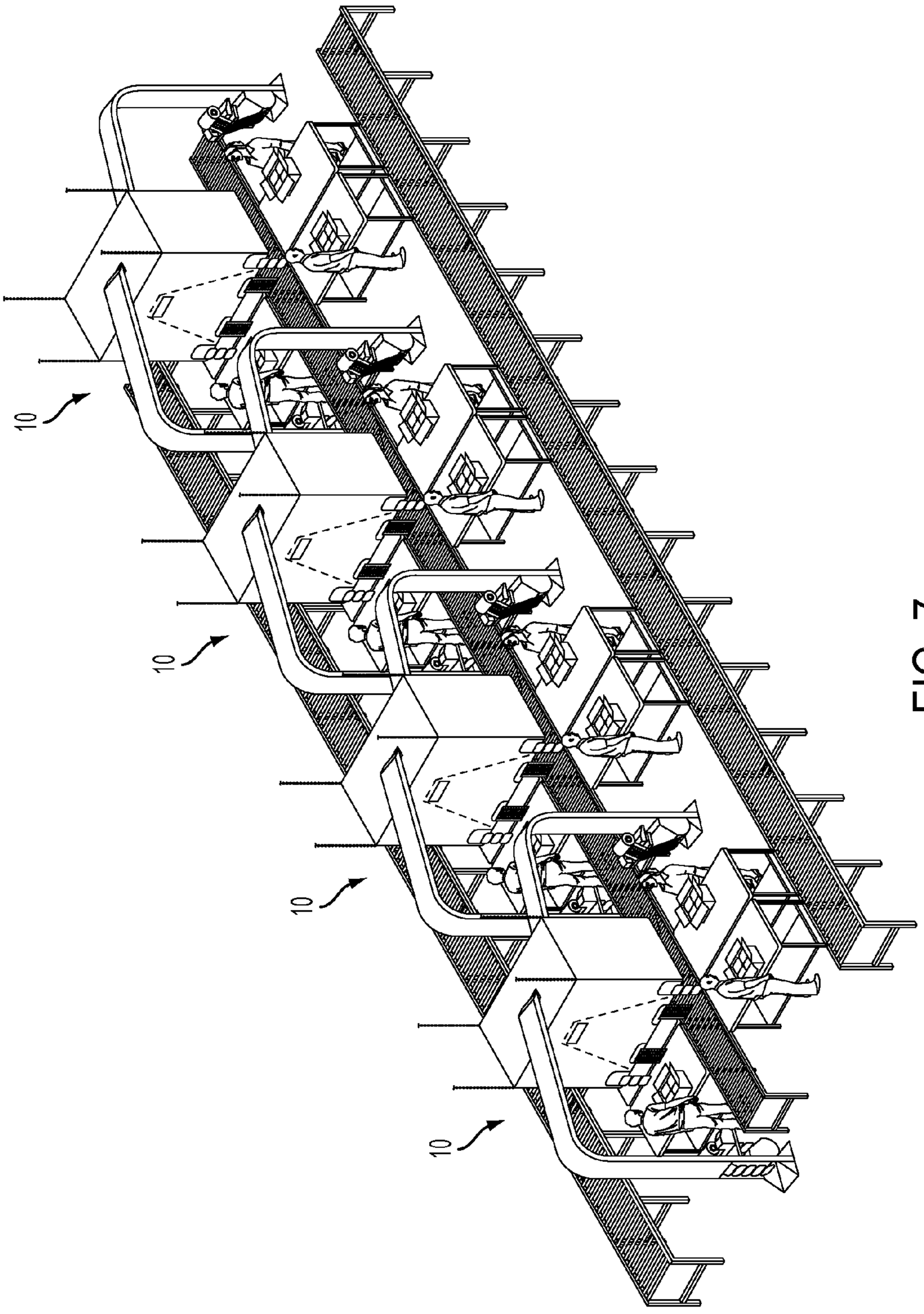


FIG. 7

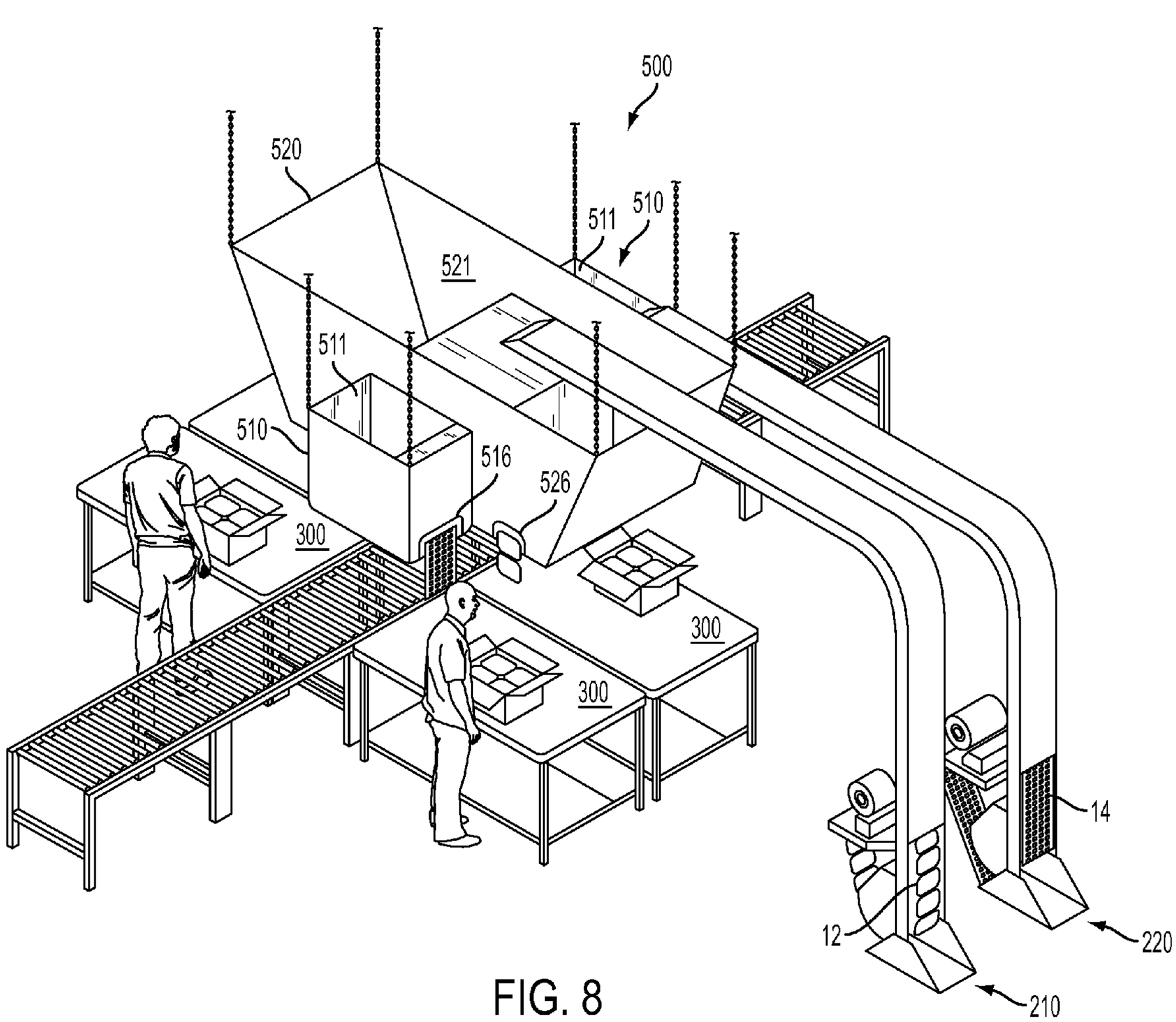


FIG. 8

DISPENSING BIN FOR MULTIPLE MATERIALS

BACKGROUND OF THE INVENTION

1. Field of the Invention

Various embodiments of the present invention described herein generally relate to apparatuses and methods for dispensing multiple materials, and in particular to dispensing different types of packing materials from a single dispensing apparatus.

2. Description of Related Art

Packing materials are commonly used in the packaging industry to protect packaged items as they are being shipped. In particular, many items are packaged with multiple types of packing materials, which work together to protect an item during shipping. For example, before being placed in a shipping container, items are often wrapped or covered with an air-filled protective cushioning material, such as Bubble Wrap® brand protective cushioning. The air-filled protective cushioning serves to protect the packaged item by absorbing impacts that might otherwise be fully transmitted to the packaged item during transit. In addition, items are often packaged with air-filled dunnage cushions, such as Fill-Air® brand cushions. The air-filled dunnage cushions—also referred to as void-fill cushions—serve to fill otherwise open space in the item's shipping container and restrict the movement of the packaged item within the container to further reduce the likelihood of damage to the item. Multiple types of non-air-filled materials, such as foam dunnage or protective materials are also commonly used in packaging items.

Businesses that pack and ship items often have packaging operations including numerous packing stations at which workers pack items with packing materials. The packaging operation may include a number of systems configured to provide a particular type of material (e.g., air-filling an air-filled packing material) and deliver the packing material to an overhead bin positioned at a respective packing station. The bin may be configured to dispense the packing material to workers at the packing station for use in packaging various items.

As an example, U.S. Pat. No. 6,996,955 describes a system for making and delivering air-filled dunnage cushions to multiple packing stations. In particular, the '955 patent suggests providing a cushion supply machine that air-fills and delivers strings of air-filled dunnage cushions via ducting to a plurality of hoppers each positioned above packing stations. Similarly, U.S. Pat. No. 7,273,142 describes a system for delivering packaging cushions to multiple hoppers positioned above packing stations via a conveyor. However, these systems are only configured for supplying and dispensing a single type of air-filled material to their respective packing stations.

Accordingly, there remains a need in the art for an apparatus that can distribute multiple types of materials to numerous packing stations. In addition, there is a particular need for such an apparatus to conserve floor space in a manufacturing environment and to have a low cost of production and installation.

BRIEF SUMMARY OF THE INVENTION

Various embodiments of the present invention are directed to a bin for dispensing first and second materials. According to various embodiments, the bin comprises an inner compartment defining one or more inner compartment receiving apertures providing access for loading the first material into the inner compartment and defining one or more inner compartment dispensing apertures providing access for dispensing the first material from the inner compartment; and an outer compartment providing access for loading the second material into the outer compartment and defining one or more outer compartment dispensing apertures providing access for dispensing the second material from the outer compartment. In various embodiments, at least an elevated portion of the outer compartment is positioned above the inner compartment and at least a surrounding portion of the outer compartment surrounds a lateral portion of the inner compartment. Furthermore, in various embodiments, the bin is configured to receive and dispense the first and second materials without commingling the first and second materials.

In addition, various embodiments of the present invention are directed to method of dispensing first and second materials from the above-described bin. According to various embodiments, the method comprises the steps of: loading the first material into the inner compartment of the bin; loading the second material into the outer compartment of the bin; accessing the first material via one or more of the inner compartment dispensing apertures of the bin and removing the first material from the inner compartment of the bin; and accessing the second material via one or more of the outer compartment dispensing apertures of the bin and removing the second material from the inner compartment of the bin.

In addition, various other embodiments of the present invention are directed to a system for dispensing first and second materials. According to various embodiments, the system comprises a bin comprising an inner compartment defining one or more inner compartment dispensing apertures and an outer compartment defining one or more outer compartment dispensing apertures; a first material supply machine configured for conveying the first material into the inner compartment; and a second material supply machine configured for conveying the second material into the outer compartment. In various embodiments, the inner and outer compartments are configured such that first materials disposed within the inner compartment are directed to the inner compartment dispensing apertures and second materials disposed within the outer compartment are directed to the outer compartment dispensing apertures, the inner and outer compartments preventing commingling of the first and second materials within the bin.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

Reference will now be made to the accompanying drawings, which are not necessarily drawn to scale, and wherein:

FIG. **1** shows a perspective view of a dispensing bin according to one embodiment of the present invention;

FIG. **2** shows a side plan view of a dispensing system according to one embodiment of the present invention;

FIG. **3** shows a perspective view of a string of air-filled dunnage cushions according to one embodiment of the present invention;

FIG. **4** shows a perspective view of a sheet of air-filled protective material according to one embodiment of the present invention;

FIG. **5** shows a front plan view of a bin receiving and dispensing air-filled materials according to the embodiment of FIG. **1**;

FIG. **6** shows a perspective view of a dispensing system in a packaging environment according to the embodiment of FIG. **2**;

FIG. **7** shows a perspective view of multiple dispensing systems in a packaging environment according to one embodiment of the present invention; and

FIG. **8** shows a perspective view of a bin and dispensing system according to another embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

The present inventions will now be described more fully hereinafter with reference to the accompanying drawings, in which some, but not all embodiments of the inventions are shown. Indeed, these inventions may be embodied in many different forms and should not be construed as limited to the embodiments set forth herein. Rather, these embodiments are provided so that this disclosure will satisfy applicable legal requirements. Like numbers refer to like elements throughout.

Various embodiments of the present invention are directed to a dispensing bin configured for dispensing multiple types of materials, as well as systems for conveying materials to such bins as part of an integrated packing operation. According to various embodiments, the dispensing bin generally comprises at least two separate compartments, each compartment being configured for receiving and dispensing packing materials. In certain embodiments, at least one of the bin's compartments is configured for receiving and dispensing a first type of packing material that flows relatively easily throughout an enclosed area (e.g., strings of air-filled dunnage cushions), while at least one other compartment is configured for receiving and dispensing a second type of packing material that is generally more resistive to flow throughout an enclosed area (e.g., sheets of air-filled protective cushioning).

According to certain embodiments, in order to dispense both types of packing materials, the bin's first and second compartments include one or more dispensing apertures positioned such that at least one of the first compartment's dispensing apertures is positioned proximate to at least one of the second compartment's dispensing apertures. By locating pairs of dispensing apertures at different points around the perimeter of the bin, a single bin can be configured to dispense multiple types of packing materials to numerous packing stations. In addition, this configuration permits a single supply machine to provide a particular type of packing material to a plurality of packing stations, thereby reducing the amount of floor space required to produce and dispense the packing material. Various embodiments of the dispensing bin are described below, along with various embodiments of systems for conveying packing materials as part of an integrated packing operation.

Dispensing Bin

FIG. **1** illustrates a dispensing bin **100** according to one embodiment. As described in detail below, the bin **100** includes two compartments in the form of an inner compartment **110** and outer compartment **120**, each of which is configured to receive and dispense different types of materials (e.g., different types of packing materials).

In the illustrated embodiment of FIG. **1**, the bin **100** comprises a plurality of outer walls including four sidewalls **102**, a bottom wall **104**, and a top wall **106**. The bin **100** further comprises a plurality of inner walls including two sloped walls **111** and an upper wall **112**. As shown in FIG. **1**, the lower ends of the sloped walls **111** are affixed to the bin's bottom wall **104** and the upper ends of the sloped walls **111** are affixed to the upper wall **112**. In addition, the sides of each of the sloped walls **111** are affixed to two of the bin's sidewalls **102**. Likewise, the ends of the upper wall **112** are affixed to the bin's sidewalls **102** proximate to the upper ends of the sloped walls **111**. In the illustrated embodiment of FIG. **1**, the sloped walls **111** intersect with the bottom wall **104** to form an acute angle with an inner compartment portion of the bottom wall **104** of approximately 45 degrees. However, as will be appreciated from the description herein, the sloped walls **111** may form any wider or narrower acute angles. For example, various embodiments of the bin **100** include sloped walls **111** forming acute angles between 30 and 60 degrees.

The bin's various inner and outer walls define the inner compartment **110** and the outer compartment **120**. In particular, the inner compartment **110** is comprised of the volume within the inner walls, while the outer compartment **120** is comprised of the volume between the inner walls and outer walls. As will be appreciated from FIG. **1**, the inner compartment **110** has a generally rectangular horizontal cross-section, the area of which decreases toward the upper portions of the inner compartment **110** as a result of the sloped walls **111**. Correspondingly, the outer compartment **120** includes an elevated portion that extends above the inner compartment's upper wall **112** and surrounding portions positioned on the sides of the inner compartment's sloped walls **111**. As described in greater detail herein, the inner compartment **110** and outer compartment **120** are configured to separately receive, contain, and dispense different types of packing materials.

The bin's outer walls also define a plurality of apertures dimensioned for receiving and dispensing packing materials. In the illustrated embodiment, the bin's sidewalls **102** define an outer compartment receiving aperture **107** and four outer compartment dispensing apertures **108**. The outer compartment receiving aperture **107** is defined in a medial portion of the top wall **106** and is dimensioned for receiving the end of a duct or conveyor arm from which packing materials may be dispensed into the outer compartment **120**. As shown in FIG. **1**, the outer compartment dispensing apertures **108** are positioned proximate each of the bin's four corners, near the edges of the sidewalls **102** and bottom wall **104**. As described in greater detail herein, in the illustrated embodiment, the outer compartment dispensing apertures **108** are dimensioned for dispensing strings of air-filled dunnage cushions.

The bin's sidewalls **102** also define two inner compartment receiving apertures **115** and four inner compartment dispensing apertures **116**. The inner compartment receiving apertures **115** are positioned just below either end of the inner compartment's upper wall **112** and adjacent the upper ends of the sloped walls **111**. Both inner compartment receiving apertures **115** are dimensioned for receiving the end of a duct or conveyor arm from which packing materials may be dispensed into the inner compartment **110**. As shown in FIG. **1**, the inner compartment dispensing apertures **116** are positioned proximate each of the four outer compartment dispensing apertures **108**, adjacent the bottom wall **104** and the lower ends of the angle walls **111**. For example, in various embodiments, the inner compartment dispensing apertures **116** are positioned proximate enough to the outer compartment dispensing apertures **108** to enable a human of average size to access packing materials dispensed from a pair of apertures **116**, **118**. As such, in certain embodiments, the inner compartment dispensing apertures **116** are positioned within six feet of the nearest outer compartment dispensing aperture **108**. As described in greater detail herein, in the illustrated embodiment, the inner compartment dispensing apertures **116** are dimensioned for dispensing sheets of air-filled protective cushioning.

As noted above, the bin's compartments **110**, **120** are generally configured to receive, contain, and dispense different

types of packing material. As such, according to various embodiments, the bin **100** may be constructed from any materials capable of defining the bin's inner and outer walls and maintaining separation of the packing materials disposed in the compartments **110**, **120**. This configuration prevents commingling of the different packing materials disposed in the compartments **110**, **120**. For example, in certain embodiments, the bin **100** is constructed from a lightweight, translucent nylon or mesh material. In such embodiments, the material's lightweight permits the bin **100** to be suspended from a variety of fixtures, while the material's translucent properties permit workers in a packaging environment to see within the bin **100** and monitor the packing materials contained therein. In embodiments where the bin **100** is constructed from flexible materials, such as fabric or plastic materials, the bin's walls may be joined together by stitching, rivets, adhesives, bonding, or other joining techniques to form seams between the various inner and outer walls.

System for Dispensing Packing Materials

FIG. **2** illustrates a system **10** for dispensing multiple packing materials according to one embodiment. In the illustrated embodiment, the system **10** comprises the above-described bin **100**, a dunnage material supply machine **210**, and a protective material supply machine **220**. As shown in FIG. **2**, which provides a cut-away side view of the system **10**, the bin **100** is suspended above packing stations by chains **16** (e.g., from a ceiling or other fixture) and filled with air-filled packing material by the supply machines **210**, **220**. As will be appreciated from the description herein, in various other embodiments, the bin **100** may be positioned above the packing stations by various other methods (e.g., mounting the bin on rigid legs or scaffolding resting on a floor surface)

In the illustrated embodiment, the dunnage material supply machine **210** is configured to air-fill and convey strings of dunnage cushions. For example, in one embodiment, the dunnage material supply machine **210** comprises a Fill-Air Cyclone® System (manufactured by Sealed Air Corporation) that is configured to air-fill and convey strings of Fill-Air® brand cushions.

FIG. **3** illustrates a string of air-filled dunnage cushions **12** generated by the supply machine **210** according to one embodiment. As shown in FIG. **3**, the string comprises a plurality of air-filled dunnage cushions **12** separated by gaps **402** of plastic film material. The air-filled dunnage cushions **12**, also referred to as void-fill cushions, are generally configured for filling open space in an item's shipping container in order to restrict the movement of the item within the container. Accordingly, in certain embodiments, the gaps **402** between the air-filled dunnage cushions **12** may be perforated to enable workers to easily separate one or more dunnage cushions **12** from the string and place them in a package.

In the illustrated embodiment, the protective material supply machine **220** is configured to generate sheets of air-filled protective cushioning. For example, in one embodiment, the protective material supply machine **220** comprises a NewAir I.B.® Express System (manufactured by Sealed Air Corporation) that is configured to air-fill and covey sheets of Barrier Bubble® or Bubble Wrap® brand protective cushioning.

FIG. **4** illustrates a sheet of air-filled protective material **14** generated by the supply machine **220** according to one embodiment. As shown in FIG. **4**, the air-filled protective cushioning **14** comprises a plurality of small, air-filled air pockets **501** connected by small air channels **502**. The air pockets **501** and channels **502** are aligned in rows across the width of the sheet of protective cushioning **14**. In addition, the adjacent rows of air pockets **501** are staggered such that each air pocket **501** is generally aligned with the space separating pairs of air pockets **501** in the adjacent rows. The air-filled protective material **14** is generally configured for being wrapped around a packaged item in order to absorb impacts that might otherwise be fully transmitted to the item during transit. Accordingly, in certain embodiments, perforations may be disposed across the width of the sheets of air-filled protective material **14** to enable workers to easily separate lengths of protective material **14** and wrap them around items awaiting packaging.

As shown in FIG. **2**, the supply machines **210**, **220** are configured for conveying the strings of air-filled dunnage cushions **12** and sheets of air-filled protective material **14** into the bin **100**. However, when dispensed into an enclosed area, the strings of air-filled dunnage cushions **12** and sheets of air-filled protective material **14** exhibit different flow characteristics. For example, the film gaps **402** between the air-filled dunnage cushions **12** permit the strings of air-filled dunnage cushions **12** to remain flexible. In addition, in certain embodiments, the dunnage cushions **12** are manufactured from a relatively thin-gauge film material, thereby enhancing the overall flexibility of the strings. As a result, the strings of air-filled dunnage cushions **12** tend to flow relatively easily throughout an enclosed area, such as the bin **100**.

In contrast, the air-filled portions of the protective cushioning **14** are comparatively stiff. As a result, the laterally-aligned air-filled pockets **501** and air-filled channels **502** impart a stiffness to the protective cushioning **14** that makes the sheets comparatively resistive to being twisted or folded about their longitudinal axis. In addition, the numerosity and proximity of the air pockets **501** to one another adds further to the comparative stiffness of the air-filled protective material **14**. Furthermore, in certain embodiments, the air-filled protective cushioning **14** is manufactured from a thicker-gauge film material that is less pliable than the film material used in the dunnage cushions **12**. As such, the sheets of air-filled protective material **14** is generally flow less easily through an enclosed area than the strings of air-filled dunnage material **12**.

In order to accommodate the differing flow characteristics of the strings of dunnage cushions **12** and sheets of air-filled protective material **14**, the system **10** of FIG. **2** is configured convey the air-filled protective material **14** into the inner compartment **110** and the dunnage cushions **12** into the outer compartment **120**. In particular, the protective material supply machine **220** conveys the sheets of air-filled protective material **14** through ducting **222** and into the inner compartment **110** via one of the inner compartment receiving apertures **115**. Likewise, the dunnage material supply machine **210** conveys the air-filled dunnage cushions **12** through ducting **212** and into the outer compartment **120** via the outer compartment receiving aperture **107**. This configuration permits the less-fluid sheets of air-filled protective cushioning **14** to amass within the inner compartment **110**, while the more-fluid strings of air-filled dunnage cushions **12** flow around the inner compartment **110** and into both sides of the outer compartment **120**.

FIG. **5** illustrates a cut-away front view of the bin **100** as it is being filled with air-filled material **12**, **14**. As shown in FIG. **5**, the strings of air-filled dunnage cushions **12** are conveyed through the outer compartment receiving aperture **107** and fall downward, where they are met by the inner compartment's upper wall **112** and directed to the lateral portions of the outer compartment **120**. The strings of air-filled dunnage cushions **12** then fall alongside the inner compartment's sloped walls **111** and toward the outer compartment dispensing apertures **108**. The above-described flow characteristics of the strings of air-filled dunnage cushions **12** permit them to

flow easily throughout the outer compartment **120** and to each of the four outer compartment dispensing apertures **108**.

While the air-filled dunnage cushions **12** fill the outer compartment **120**, the sheets of air-filled protective cushioning **14** are conveyed through one of the inner compartment receiving apertures **115** and fall downward onto the bottom wall **104** of the bin **100**. As shown in FIG. **3**, the sheets of air-filled protective material **14** settle in folded layers proximate each of the inner compartment dispensing apertures **116**. Accordingly, as the material supply machines **210**, **220** convey the air-filled materials **12**, **14** into the bin **100**, the compartments **110**, **120** are filled and both strings of air-filled dunnage cushions **12** and sheets of air-filled protective cushioning **14** are positioned proximate the pairs of apertures **108**, **116** at each of the bin's four corners. As a result, the bin **100** is capable of receiving each type of air-filled material **12**, **14** from a single input source (e.g., the one supply machine **210** and one supply machine **220**) and distributing the material to four separate access points (e.g., the four corners of the bin **100** having dispensing apertures **108**, **116**).

According to various embodiments, the system **10** may be adapted to distribute air-filled dunnage cushions **12** and air-filled protective material **14** to multiple workers in a packaging operation. For example, FIG. **6** shows a packaging environment according to one embodiment in which the system **10** is integrated for dispensing air-filled dunnage cushions **12** and air-filled protective material **14** to four packing stations **300**. In the illustrated embodiment, the packing stations **300** are positioned around a central roller conveyor **302**. The bin **100** is suspended such that it is centered above the roller conveyor **302** and its four corners are each proximate one of packing stations **300**. As a result, a pair of outer compartment and inner compartment dispensing apertures **108**, **116** is positioned proximate to each of the packing stations **300**. As the material supply machines **210**, **220** convey the air-filled materials **12**, **14** to the bin **100**, the compartments **110**, **120** are filled and both the strings of air-filled dunnage cushions **12** and sheets of air-filled protective cushioning **14** are accessible to the workers at each of the packing stations **300** via the apertures **108**, **116**. As such, the bin **100** enables each supply machine **210**, **220** to deliver its respective air-filled material **12**, **14** to four separate packing stations **300** and, thereby, four individual workers.

In the illustrated embodiment of FIG. **6**, no more than two supply machines **210**, **220** and no more than a single overhead bin **100** are required to provide both types of air-filled material **12**, **14** to each of the four packing stations **300**. As a result, the system **10** conserves a significant amount of floor space in the environment of FIG. **6** and reduces the number of supply machines **210**, **220** necessary to supply the air-filled material **12**, **14** required by the packing operation. In further embodiments, multiple systems **10** may be provided in a packaging operation to provide dispense air-filled material to additional workers. For example, FIG. **7** illustrates a packing environment in which multiple dispensing systems **10** are provided at multiple packing station clusters arranged as part of an integrated packaging operation.

As will be appreciated from the description herein, the bin **100** and system **5** may be used as part of a method for dispensing different types of materials. For example, in one embodiment, a method for dispensing a first material and a second material is contemplated comprising the following steps. To begin, the first material is loaded into the inner compartment **110** via one of the inner compartment receiving apertures **115** (e.g., manually or by using the first material supply machine **210**). Next, the second material is loaded into the outer compartment **120** (e.g., via the outer compartment receiving aperture **107** or an open upper region of the outer compartment **120**, and accomplished manually or by using the second material supply machine **220**). Next, the first material is removed from the inner compartment **110** of the bin **100** via access at one of the inner compartment dispensing apertures **116** and the second material is removed from the outer compartment **120** of the bin **100** via access at one of the outer compartment dispensing apertures **108**.

Additional Embodiments of the Dispensing Bin

As will be appreciated from the description herein, various modifications may be made to the dispensing bin **100** described herein while remaining compatible with the dispensing systems described herein and remaining within the scope of the present inventions. For example, in certain embodiments, the bin **100** may not include a top wall **106**, leaving the top of the bin **100** generally open. In such embodiments, the system **10** may be configured such that its dunnage material supply machine **210** conveys strings of air-filled dunnage cushions **12** into the bin's upper opening, as opposed to a particular receiving aperture. In addition, the bin **100** may include more, or less, receiving and dispensing apertures for each of the inner compartment **110** and outer compartment **120**. As will be appreciated from the description herein, according to various embodiments, the number of and position of receiving and dispensing apertures may vary according to the requirements of the dispensing system and packing environment for which the bin **100** is configured. For example, in certain embodiments, more than four pairs of inner compartment and outer compartment dispensing apertures **108**, **116** may defined on the bin **100** in order to provide more than four access points for the packing materials dispensed therefrom. In addition, the receiving and dispensing apertures **108**, **116**, **107**, **115** may be defined at various locations on the bin **100**. For example, in certain embodiments, the dispensing apertures **108**, **116** may be defined proximate the center of the bin's sidewalls **102**. In certain embodiments the dispensing apertures **108**, **116** are defined on the bottom wall **104** of the bin **100**. In other embodiments, the receiving apertures are positioned beneath the dispensing apertures (e.g., to enable the material supply machines **210**, **220** to force material upwardly through the bin **100**).

Furthermore, according to various embodiments, the inner compartment **110** and outer compartment **120** may be configured in a variety of shapes and sizes while remaining capable of directing packing materials disposed in the compartments **110**, **120** to one or more dispensing apertures. For example, in certain embodiments the sloped walls **111** of the inner compartment **110** may be substantially vertical. In other embodiments, the inner compartment **110** may not include a top wall **112**. In further embodiments, the inner compartment **110** or outer compartment **120** may have a non-rectangular cross-section, such as an elliptical cross-section. In addition, the inner compartment **110** and outer compartment **120** may be reconfigured as necessary to provide for additional receiving or dispensing apertures in various locations around the bin **100**. For example, in one embodiment the inner compartment may include a portion extending to the lateral sides of the bin **100** in order to provide additional inner compartment dispensing apertures. In other embodiments, the bin **100** may include additional compartments, such as multiple inner and/or outer compartments configured to direct packing materials disposed therein to one or more dispensing apertures.

As yet another example of the configuration of the bin's inner and outer compartments, FIG. **8** shows a bin **500** according to another embodiment. The bin **500** includes an inner compartment **510** and an outer compartment **520** that are each generally elongated and oriented such that they are

substantially perpendicular to one another. In the illustrated embodiment, the inner compartment **510** defines a pair of upper openings **511** and a plurality of dispensing apertures **516**. Likewise, the outer compartment **520** defines an upper opening **521** and a plurality of dispensing apertures **526**. The dispensing apertures are positioned such that pairs of inner compartment and outer compartment dispensing apertures **516**, **526** are positioned together at corners of the bin **500**.

As shown in FIG. **8**, the inner compartment **510** and outer compartment **520** are oriented perpendicular to one another such that a first portion of the outer compartment **520** extends above a medial portion of the inner compartment **510** and a second portion of the outer compartment **520** surrounds the lateral sides of the medial portion of the inner compartment **510**. In the illustrated embodiment, the medial portion of the inner compartment **510** includes an upper wall which ensures the inner compartment **510** is not open to the outer compartment **520**. This configuration permits a protective material supply machine **220** to convey sheets of protective material **14** to the inner compartment **510** via either of its upper openings **511**, while a dunnage material supply machine **210** conveys strings of dunnage cushions **12** to the outer compartment **520** via its upper opening **521**.

Similarly to the bin **100** of FIG. **3**, the sheets of protective material **14** settle in layers in the inner compartment **510** and are accessible via the plurality of dispensing apertures **516**. Meanwhile, the dunnage cushions **12** fall within the outer compartment **520** and are then directed around the medial portion of the inner compartment **510** and into lateral portions of the outer compartment **520**. As such, both the dunnage cushions **12** and air-filled protective material **14** are accessible via the dispensing apertures **516**, **526** at each corner of the bin **500**.

In the illustrated embodiment of FIG. **8**, the bin **500** is positioned above four packing stations **300**. As shown in FIG. **8**, the bin **500** permits the two supply machines **210**, **220** to provide both types of material **12**, **14** to each of the four packing stations **300**. Like the system **10** of FIG. **6**, the system of FIG. **8** conserves a significant amount of floor space and reduces the number of supply machines **210**, **220** necessary to supply the material **12**, **14** required by the packing operation.

Additional Embodiments of the Dispensing System

As will be appreciated from the description herein, various modifications may also made to the system **10** described herein while remaining compatible with the various dispensing bins described herein and remaining within the scope of the present inventions. For example, in certain embodiments the supply machines **210**, **220** may be configured to convey their respective materials via conveyors. In further embodiments, one or more sensors (e.g., an optical sensor) may be provided on the bin **100** to automatically detect when inner and outer compartments **110**, **120** are sufficiently filled with material or need to be supplied with additional material from the supply machines **210**, **220**. In such embodiments, the supply machines **210**, **220** may be configured to automatically refill the bin **100** based on feedback from the sensors.

In the illustrated embodiment of FIG. **7**, a pair of supply machines **210**, **220** are provided at each packing station cluster. However, in other embodiments, a single supply machine **210**, **220** could be configured to covey its respective material **12**, **14** to a plurality of packing stations. For example, in one embodiment, the dunnage material supply machine **210** may be provided with ducting that extends above a plurality of bins **100** and is configured to selectively direct dunnage cushions **12** to each of the plurality of bins (e.g., using a variety of outlets along the ducting). Likewise, in one embodiment, the protective material supply machine **220** may be provided with ducting that extends through a plurality of bins **100** and is configured to selectively direct sheets of protective material **14** to each of the plurality of bins.

Furthermore, the system **10** may be configured to convey different types of materials other than those specifically described herein. For example, the system **10** could include supply machines configured to convey different sized strings of dunnage cushions **12**, one size being disposed in one bin compartment and another size being disposed in another bin compartment. Indeed, various other types of air-filled packing materials having properties analogous to those described herein could be generated and conveyed by supply machines and dispensed by the various bin embodiments described herein. Likewise, the systems and dispensing bins described herein may be adapted to convey and dispense non-air-filled materials, such as paper dunnage or foam cushioning materials (e.g., polyethylene foam materials).

CONCLUSION

Many modifications and other embodiments of the inventions set forth herein will come to mind to one skilled in the art to which these inventions pertain having the benefit of the teachings presented in the foregoing descriptions and the associated drawings. Therefore, it is to be understood that the inventions are not to be limited to the specific embodiments disclosed and that modifications and other embodiments are intended to be included within the scope of the appended claims. Although specific terms are employed herein, they are used in a generic and descriptive sense only and not for purposes of limitation.

That which is claimed:

1. A bin for dispensing first and second materials, the bin comprising:

an inner compartment defining one or more inner compartment receiving apertures providing access for loading the first material into the inner compartment and defining one or more inner compartment dispensing apertures providing access for dispensing the first material from the inner compartment; and

an outer compartment providing access for loading the second material into the outer compartment and defining one or more outer compartment dispensing apertures providing access for dispensing the second material from the outer compartment, wherein at least an elevated portion of the outer compartment is positioned above the inner compartment and at least a surrounding portion of the outer compartment surrounds a lateral portion of the inner compartment;

wherein the bin is configured to receive and dispense the first and second materials without commingling the first and second materials.

2. The bin of claim **1**, wherein at least one of the outer compartment dispensing apertures is positioned proximate at least one of the one or more inner compartment dispensing apertures.

3. The bin of claim **2**, wherein the at least one outer compartment dispensing aperture positioned proximate at least one inner compartment dispensing aperture is positioned within six feet of the nearest inner compartment dispensing aperture.

4. The bin of claim **1**, wherein the inner compartment and outer compartment are configured such that first materials loaded into the inner compartment are directed to the inner compartment dispensing apertures and such that second materials disposed within the outer compartment are directed

over and around at least a portion of the inner compartment to the outer compartment dispensing apertures.

5. The bin of claim **1**, wherein the inner compartment and outer compartment define at least four pairs of dispensing apertures, each dispensing aperture pair comprising one of the inner compartment dispensing apertures and one of the outer compartment dispensing apertures positioned proximate one another, and wherein each pair of dispensing apertures is substantially spaced apart from the other pairs of dispensing apertures.

6. The bin of claim **1**, wherein the inner compartment and outer compartment are each generally elongated and oriented such that they are substantially perpendicular to one another.

7. The bin of claim **1**, further comprising:

one or more outer walls defining an at least partially enclosed area, wherein the one or more inner compartment receiving apertures, one or more inner compartment dispensing apertures, and one or more outer compartment dispensing apertures are defined in at least one of the outer walls; and

one or more inner walls, wherein at least a portion of the volume within the inner walls comprises the inner compartment and at least a portion of the volume between the inner walls and outer walls comprises the outer compartment.

8. The bin of claim **7**, wherein the outer walls comprise one or more side walls and at least one bottom wall, the one or more side walls extending upwardly from the at least one bottom wall; and

wherein the inner walls comprise one or more sloped walls having lower ends positioned adjacent the bottom wall, wherein at least one inner compartment receiving aperture is defined on at least one of the side walls and is positioned proximate the upper ends of the sloped walls and wherein at least one outer compartment dispensing aperture is positioned proximate the lower ends of the one or more sloped walls.

9. The bin of claim **8**, wherein the one or more sloped walls each form an angle with an inner compartment portion of the bottom wall that is between 30 and 60 degrees.

10. The bin of claim **8**, wherein the side walls are configured such that the bin has a rectangular cross-section having four corners; and wherein at least one outer compartment dispensing aperture and at least one inner compartment dispensing aperture are positioned proximate each of the bin's four corners.

11. The bin of claim **8**, wherein the outer walls further comprise a top wall defining at least one outer compartment receiving aperture.

12. A method of dispensing first and second materials, the method comprising the steps of:

loading the first material into the inner compartment of the bin of claim **1**;

loading the second material into the outer compartment of the bin of claim **1**;

accessing the first material via one or more of the inner compartment dispensing apertures of the bin of claim **1** and removing the first material from the inner compartment of the bin of claim **1**; and

accessing the second material via one or more of the outer compartment dispensing apertures of the bin of claim **1** and removing the second material from the inner compartment of the bin of claim **1**.

13. The method of claim **12**, wherein the step of loading the first material is accomplished by loading the first material through the bin's inner compartment receiving aperture; and wherein the step of loading the second material is accomplished by loading the second material through an outer compartment receiving aperture provided on the bin of claim **1**.

14. The method of claim **12**, wherein the first material and second material are air-filled materials.

15. The method of claim **14**, wherein the first material and second material are different types of materials.

16. The method of claim **15**, wherein the first material comprises a sheet of air-filled protective cushioning and the second material comprises a string of air-filled dunnage cushions.

17. The method of claim **15**, wherein the second material flows more easily through an enclosed area than the first material.

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